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मानक

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Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 4049-2 (1996): Formed ends for tanks and pressure vessels, Part 2: Based on inside diameter basis [MED 17: Chemical Engineering Plants and Related Equipment]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

REAFFIRMED

टैंक और प्रेशर वैसल के लिए फॉर्मड सिरे — विशिष्ट

2006

भाग 2 आंतरिक व्यास आधार

(पहला पुनरीक्षण)

Indian Standard

FORMED ENDS FOR TANKS AND
PRESSURE VESSELS — SPECIFICATION

PART 2 INSIDE DIAMETER BASIS

(*First Revision*)

First Reprint MAY 2006

ICS 23.020.10; 23.020.30

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

AMENDMENT NO. 1 JULY 2006
TO
IS 4049 (PART 2) : 1996 FORMED ENDS FOR TANKS
AND PRESSURE VESSELS — SPECIFICATION
PART 2 INSIDE DIAMETER BASIS

(First Revision)

(Page 1, clause 4.3) — Substitute following for the existing clause:

‘4.3 Length of the Straight Flange — The length of the straight flange shall not be less than three times the end thickness with a minimum of 38 mm, unless otherwise agreed to between the manufacturer and the purchaser.’

(ME 17)

AMENDMENT NO. 2 APRIL 2011
TO
IS 4049 (PART 2) : 1996 FORMED ENDS FOR TANKS
AND PRESSURE VESSELS — SPECIFICATION

PART 2 INSIDE DIAMETER BASIS

(First Revision)

(Page 1, clause 3.1.3, Note 2):

- a) Substitute ' $h_i = R_i - \sqrt{[(R_i - D_i/2) \times (R_i + D_i/2 - 2r_i)]}$ ' for ' $h_i = R_i - (R_i - D_i/2) \times (R_i + D_i/2 - 2r_i)$ '.
- b) Substitute ' $h_o = R_o - \sqrt{[(R_o - D_o/2) \times (R_o + D_o/2 - 2r_o)]}$ ' for ' $h_o = R_o - (R_o - D_o/2) \times (R_o + D_o/2 - 2r_o)$ '.

FOREWORD

This Indian Standard (Part 2) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Engineering Plants and Related Equipment Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This standard was first published in 1979. This revision of the standard is being brought out to bring it in line with the latest practices being followed in the country. The important modifications being:

- a) length of the straight flange revised from 20 mm minimum to 38 mm minimum;
- b) tolerance on circularity, that is the difference between the maximum and minimum diameter increased; and
- c) provision of shallow dished and flanged ends having knuckle radius of 6 percent withdrawn.

Formed ends are used as end closures for pressure vessels, receivers and similar equipments. IS 2825:1969 'Code for unfired pressure vessels' specifies any one of the following shapes for the ends:

- a) Hemispherical,
- b) Semi-ellipsoidal,
- c) Dished and flanged, and
- d) Conical.

In this specification only semi-ellipsoidal, dished and flanged ends are covered. The code for unfired pressure vessels (IS 2825:1969) also permits deeper or slightly shallower semi-ellipsoidal ends and dished and flanged ends deeper than those specified in this standard. But these shapes are considered 'special' and have not, therefore, been included.

The formed ends are designated either on outside diameter basis or inside diameter basis. The Part 1 of this standard covers formed ends on outside diameter basis while this Part 2 of the standard covers formed ends on inside diameter basis.

The information to be supplied by the purchaser to the manufacturer along with the enquiry or order is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FORMED ENDS FOR TANKS AND PRESSURE VESSELS — SPECIFICATION

PART 2 INSIDE DIAMETER BASIS

(First Revision)

1 SCOPE

This standard (Part 2) specifies the profile dimensions and technical delivery conditions of dished and flanged, pressed or spun ends designed on the basis of inside diameter commonly used as end closures of pressure vessels, receivers, tanks and similar equipments.

1.1 Where the ends have reinforced or flanged-in manholes, it is recommended that they are made to the same geometric shape as the plain ends.

2 REFERENCE

This standard makes reference to IS 2825:1969 'Code for unfired pressure vessels' which is a necessary adjunct to this standard.

3 TYPES OF ENDS

3.1 The ends shall conform to one of the following shapes.

3.1.1 Deep dished and flanged ends with an internal height of dishing h_i approximately equal to one-quarter of the inside flange diameter D_i for pressure vessels, either

- a) of semi-ellipsoidal shape with the inner contour of a true ellipse having an axis ratio of 2:1 with inside diameter as given in Table 1

or

- b) of torispherical shape (see Table 1).

3.1.2 Dished and flanged ends with an internal height of dishing h_i slightly less than one-fifth of the inside flange diameter D_i suitable for pressure vessels (see Table 2).

3.1.3 Shallow dished and flanged ends for tanks and other non-pressure vessels (see Table 3).

NOTES

1 IS 2825:1969 specifies that in the case of dished and flanged ends, the inside radius of dishing (Knuckle radius) shall preferably be not less than 10 percent of the inside diameter and in no case less than 6 percent of the inside diameter or three times the thickness whichever is more.

2 In the case of ends of partial spherical form, the internal height of dishing h_i and external height of dishing h_o can be determined as follows:

$$h_i = R_i - (R_i - D_i) \times \frac{(R_i + D_i - 2 r_i)}{2}$$

$$h_o = R_o - (R_o - D_o) \times \frac{(R_o + D_o - 2 r_o)}{2}$$

where

D_i = inner diameter of dished end,

D_o = outer diameter of dished end,

R_o = outer crown radius,

R_i = inner crown radius,

r_o = outer knuckle radius, and

r_i = inner knuckle radius.

4 DIMENSIONS

4.1 Flange and Dishing Diameter

The inside diameter, the inside crown radius and inside knuckle radius shall conform to the requirements of Tables 1, 2 and 3.

4.2 Thickness

4.2.1 Minimum thickness is the thickness measured at the thinnest point after manufacture of the dished ends. Nominal thickness is the thickness of the plate used in manufacturing of the dished end.

4.2.2 The minimum thickness shall be supplied by the purchaser based on internal/external pressure and other design loading inclusive of corrosion/erosion allowance as per IS 2825 : 1969. For non-pressure vessels and tanks, the minimum thickness shall be as agreed to between the purchaser and the manufacturer.

4.3 Length of the Straight Flange

Minimum length of the straight flange shall be three times the end thickness but need not exceed 38 mm except when necessary to provide required length of taper.

4.4 Tolerances

The ends shall be true to shape within the limits specified in 4.4.1 to 4.4.4 below, unless more stringent tolerances are specified by the purchaser.

4.4.1 Circumference

The inside circumference of the straight flange of the finished end shall not depart from the circumference calculated from the inside diameter by more than the values given below:

Inside diameter upto ± 5 mm
and including 400 mm

Inside diameter over ± 0.25 percent
400 mm

4.4.2 Circularity

The difference between the maximum and the minimum inside diameters of the straight flange shall not exceed one percent of inside diameter and shall in no case be greater than $\frac{D_i + 2500}{200}$

4.4.3 Thickness

From the point where the crown radius R_i joins the knuckle radius r_i and at the point where the knuckle radius r_i joins the straight portion of the flange end, a gradual thinning is permissible up to maximum of 10 percent of the nominal thickness or 2 mm whichever is higher. A similar gradual thinning is permissible for ends of semi-ellipsoidal shape. Due to gathering of material, the thickness in the straight portion of the flange may increase. This shall not exceed 15 percent of the nominal thickness of the plate. Thickness of the thinnest point of dished end shall not be less than the minimum thickness specified by the purchaser.

NOTE — Where dished ends are provided with flanges in manholes, the thinning is permissible up to a maximum of 40 percent of the nominal thickness on the major axis and 15 percent of the nominal thickness on the minor axis.

4.4.4 Profile

The inside depth of dishing h_i shall not be less than the theoretical depth nor shall this depth exceed by more than 1.25 percent of the inside diameter D_i of the dished end.

5 MATERIAL

The material of construction shall be carbon steel or low alloy or high alloy steel or non-ferrous metal. The exact specification shall be specified by the purchaser in his order.

6 TECHNICAL DELIVERY CONDITIONS

The following details regarding technical delivery conditions for dished ends shall be included.

6.1 Heat-Treated Conditions

The dished ends shall be delivered in heat-treated condition depending upon the process of dishing, temperature of dishing and the material specification. Heat treated condition of dished end is a subject of agreement between the manufacturer and the purchaser.

6.2 Workmanship

6.2.1 Descaling shall be carried out to measure the dimensions and to carry out visual inspection. Dished ends shall be free from any injurious defects.

6.2.2 Projection, depressions or elongated grooves usually developed during dishing are permissible so long as these depressions are not sharp and their depth is within the tolerance limits specified on the plate. Sharp grooves, laminations and other surface cracks shall be completely removed by grinding or any other suitable method.

6.2.3 Where depressions exceed the tolerance limits specified on the plate, such depressions shall be removed by grinding or by welding with the permission of the purchaser by an approved welding procedure. Hammering of surface defects is not permitted.

6.2.4 The heat treatment and radiography requirements shall be in accordance with IS 2825:1969.

6.3 Testing of Dished Ends for Material Quality

To ensure that the material properties are not impaired during the manufacture of dished ends, samples taken from dished ends after the final heat treatment shall be subjected to mechanical test for tensile strength, impact strength where necessary (for low temperature application) and bend tests as specified in the relevant specification for the plate material. The location of test plates is subject to agreement between the manufacturer and the purchaser and may be one of the following:

- Extended portion cut out from the straight flange.
- Opening cut out for nozzles
- Separate test plates from the same melt and heat number subjected to simulation similar to the dished ends.

6.4 For high alloy steel (austenitic steels in particular, dished end subjected to hot forming/heat treatment) requirement of intergranular corrosion test to check for carbide precipitation is to be carried out, wherever specified and agreed upon between the purchaser and the supplier.

6.5 In case of dished end manufactured by spinning process, the dished end is to be subjected to dye penetrant examination on the outside surface of knuckle region. If desired before by the purchaser it may be carried out on inside surface knuckle region also.

7 MARKING

7.1 The dished ends shall be marked with the following:

- Inside diameter,
- Type of dished end,
- Minimum thickness,
- Material of construction, and
- Identification of the source of manufacturer.

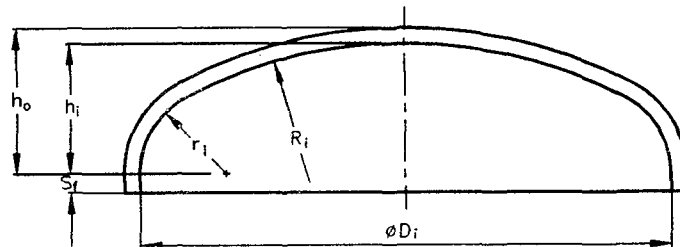
7.2 BIS Certification Marking

The dished ends may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 1 Dimensions for Deep Dished and Flanged Ends (Torispherical)
(Clauses 3.1.1 and 4.1)

All dimensions in millimetres.

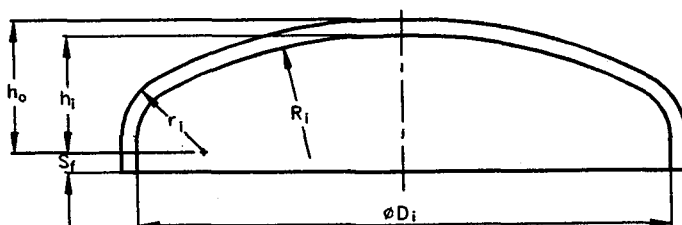


Inside Diameter D_i	Crown Radius R_i	Inside Knuckle Radius r_i	Length of Straight Flange S_f
(1)	(2)	(3)	(4)
400	320	60	See 4.3
500	400	80	
600	480	100	
700	560	125	
800	640	125	
900	720	150	
1 000	800	150	
1 100	880	175	
1 200	960	200	
1 300	1 040	200	
1 400	1 120	250	
1 500	1 200	250	
1 600	1 280	250	
1 700	1 360	300	
1 800	1 440	300	
1 900	1 520	300	
2 000	1 600	300	
2 100	1 680	350	
2 200	1 760	350	
2 300	1 840	350	
2 400	1 920	400	
2 600	2 080	400	
2 800	2 240	450	
3 000	2 400	450	
3 200	2 560	500	
3 400	2 640	600	
3 600	2 880	600	
3 800	3 040	600	
4 000	3 200	600	
4 250	3 400	700	
4 500	3 600	700	
4 750	3 800	800	
5 000	4 000	800	

NOTE — As sizes below 400 correspond to pipe caps, the dimensions shall conform to the outside diameters of pipes.

Table 2 Dimensions for Dished and Flanged Ends (Torispherical)
(Clauses 3.1.2 and 4.1)

All dimensions in millimetres.

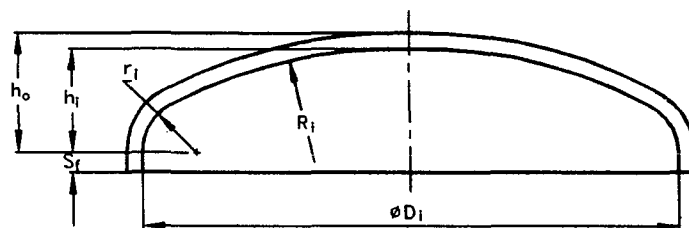


Inside Diameter D_i	Crown Radius R_i	Inside Knuckle Radius r_i	Length of Straight Flange S_r
(1)	(2)	(3)	(4)
400	400	40	See 4.3
500	500	50	
600	600	60	
700	700	75	
800	800	80	
900	900	100	
1 000	1 000	100	
1 100	1 100	125	
1 200	1 200	125	
1 300	1 300	150	
1 400	1 400	150	
1 500	1 500	150	
1 600	1 600	175	
1 700	1 700	175	
1 800	1 800	200	
1 900	1 900	200	
2 000	2 000	200	
2 100	2 100	250	
2 200	2 200	250	
2 300	2 300	250	
2 400	2 400	250	
2 600	2 600	300	
2 800	2 800	300	
3 000	3 000	300	
3 200	3 200	350	
3 400	3 400	350	
3 600	3 600	400	
3 800	3 800	400	
4 000	4 000	400	
4 250	4 250	450	
4 500	4 500	450	
4 750	4 750	500	
5 000	5 000	500	

NOTE — As sizes below 400 correspond to pipe caps, the dimensions shall conform to the outside diameters of pipes.

Table 3 Dimensions for Shallow Dished and Flanged Ends for Tanks and Non-pressure Vessels
(Clauses 3.1.3 and 4.1)

All dimensions in millimetres.



Inside Diameter D_i	Crown Radius R_i	Inside Knuckle Radius r_i	Length of Straight Flange S_f
(1)	(2)	(3)	(4)
900	950	50	See 4.3
1 000	1 200	50	
1 100	1 400	50	
1 200	1 500	50	
1 300	1 700	50	
1 400	1 700	50	
1 500	1 800	50	
1 600	2 000	50	
1 700	2 200	50	
1 800	2 400	50	
1 900	2 600	50	
2 000	2 800	50	
2 100	3 000	50	
2 200	3 300	50	
2 300	3 300	50	
2 400	3 300	50	
2 600	3 300	50	
2 800	3 500	50	
3 000	3 600	50	
3 200	4 000	50	
3 400	4 000	50	
3 600	5 000	50	
3 800	5 000	50	
4 000	5 000	50	
4 250	5 500	50	
4 500	5 500	50	
4 750	5 500	50	
5 000	5 500	60	

ANNEX A
(Foreword)

INFORMATION TO BE SUPPLIED BY THE PURCHASER

A-1 The purchaser shall supply the following information to the manufacturer with the enquiry or order:

- a) Type of dished end required;
- b) Inside diameter in millimetres;
- c) Material of construction of the dished end;
- d) Method of heat treatment;
- e) Minimum and nominal thickness of the dished end;
- f) Radiography and any other non-destructive testing, if required;
- g) Length of straight flange;
- h) Whether the flange is to be machined and weld preparation required;
- j) Special requirements for the welded joints in a dished end made from more than one plate;
- k) Inspection or survey requirements; and
- m) Manhole or any connection details, if required.

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Amendments Issued Since Publication

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